1990
ANNUAL
REPORT

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE

Alberta
AGRICULTURE

91-06602/

CONTENTS

ADMINISTRATION 2

ALBERTA TREE NURSERY & HORTICULTURE CENTRE STAFF 5

DIRECTOR'S REPORT 8

HORTICULTURE CROP DEVELOPMENT

- Seed Potato Program 11
- Micropropagation Pathology 16
- Horticulture Extension 27
- Vegetable Extension 30

PROTECTED CROPS DEVELOPMENT

- Greenhouse Program - Commodity Report 35
- Greenhouse Extension Program 36
- Greenhouse Research 38
- Micropropagation 43
- Micropropagation Research 45

NURSERY CROP DEVELOPMENT

- Commodity Report 52
- Shelterbelt Program 53
- Container Production 55
- Seed Collection 56
- Fruit Crop Production 58
- Chemical Application 58
- Research 59
- Extension 59

FARM SERVICES 60

Mr. Kris Pruski, Editor of the 1990 report.

ADMINISTRATION

Alberta Tree Nursery & Horticulture Centre - Staff 1990

George Grainger	Director

ADMINISTRATION SECTION:

Linda Hansen	Office Manager
Michele Dannish	Branch Secretary
Pat Fulton	Word Processor Operator
Helen Rekrut	Shelterbelt & Administrative Secretary
Sharon Peterson	Receptionist
Vicki Noël	Courier

Changes in the Administrative Section during 1990 included Marilyn Touchette assuming duties as Office Manager while Linda Hansen was on maternity leave. This created a secondment opportunity for Shelley Draper as Secretary to the Director of Plant Industry Division. It was with much regret that we said goodbye to her in March, leaving the Word Processor Operator position vacant. Helen Rekrut and Pat Fulton each benefited from the experience of Word Processor Operator at which Pat remains. Helen has returned to the position of Shelterbelt and Administrative Secretary. Sharon Peterson joined our staff in April as our new Receptionist.

HORTICULTURE CROP DEVELOPMENT SECTION:

James Letal	Section Head
Dr. Piara Bains	Micropropagation Pathologist
Jamie Motta	Lab Technologist
Dr. Vikram Bisht	Lab Scientist
Dr. Zvezdana Pesic-Van Esbroeck	Lab Scientist

Vegetable Section:

Belinda Choban	Vegetable Crop Extension Specialist
Dominique Bizon	Vegetable Technician

Horticulture Extension:

Betty Vladicka	Horticulture Extension Specialist
Pam North	Horticulture Information Officer
Don Geddes	Horticulture Information Officer

Seed Potato Production:

Bruce Chedzoy	Seed Potato Production Technician

Don Geddes joined the horticulture extension staff as Master Gardener Coordinator. Bruce Chedzoy left the Centre after many years and Jamie Motta, who had been working closely with the Micropropagation Pathologist as Lab Technologist, has now assumed the Seed Potato Production Technician duties.

PROTECTED CROP DEVELOPMENT SECTION:

Dr. Mohyuddin Mirza	Section Head
Kris Pruski	Tissue Culture Specialist
Muhammad Younus	Lab Technologist
Dr. Kan-Fa Chang	Lab Scientist
Sabina Pietucha	Lab Technologist

Two people joined the Protected Crop Development Section: Kan-Fa Chang is working on projects in the greenhouse lab on diseases and Sabina Pietucha is assisting in tissue culturing.

NURSERY CROP DEVELOPMENT SECTION:

Brendan Casement	Section Head

Shelterbelt Production:

Brian Breneman	Shelterbelt Production Specialist
Rulie Bok	Technician
Patricia Elliott	Gardener
Vera Fialkowski	Gardener

Arboretum and Research:

Thean Pheh	Woody Plant Research Technologist
Henry Brown	Gardener

Container Production:

Cecilia McIsaac	Container Technologist
Sophie Eckberg	Gardener

Seed Orchards:

Simone Dalpé	Seed Technologist
Nancy Moroz	Gardener

Chemicals and Seedlings:

Roy Marquardt	Chemical Application Technologist

The following staff changes occurred in the Nursery Crop Development Section in 1990. Simone Dalpé assumed the Seed Technologist position. After many years as the Centre's chemical applicator, Doug Lehman left and Roy Marquardt joined our staff to assume those duties. Pat Elliott has returned to work full-time as Gardener and thanks to Rosie Pullishy who filled in for her.

FARM OPERATIONS SECTION:

Al Faulkner	Farm Services Supervisor
Dave Wearmouth	Farm Services Foreman
Kevin Thorpe	Gardener
Brian Petherbridge	Mechanical Maintenance Chief
Stan Bootsma	Auto Mechanic
Gerhard Dames	Welder
Steve Milne	Irrigation Technician

Paul Gervais is still on Workers' Compensation and has not yet returned to work.

Alberta Tree Nursery & Horticulture Centre Staff –1990

George Grainger
Senior Manager
/Director

Administration Section

Linda Hansen
Office Manager

Michele Dannish
Branch Secretary

Pat Fulton
Word Processor

Vicki Noel
Courier

Helen Rekrut
Shelterbelt &
Administrative
Secretary

Sharon Peterson
Receptionist

Horticulture Crop Development

James Letal
Head, Horticulture
Crop Development

Piara Bains
Micropropagation
Pathologist

Betty Vladicka
Horticulture
Extension Specialist

Pam North
Horticulture
Information Officer

Don Geddes
Horticulture
Information Officer

Belinda Choban
Vegetable Crop
Extension Specialist

Dominique Bizon
Vegetable
Technologist

Jamie Matta
Seed Potato
Production
Technician

Nursery Crop Development

Brendan Casement
Head, Nursery Crop Development

Shelterbelt Production

Brian Breneman
Shelterbelt Production Specialist

Rulie Bok
Technician

Pat Elliott
Gardener

Vera Fialkowski
Gardener

Container Program

Cecilia McIsaac
Container Technologist

Sophie Eckberg
Gardener

Arboretum Research

Thean Pheh
Woody Plant Research Technologist

Henry Brown
Gardener

Seed Section

Simone Dalpe
Seed Technologist

Nancy Moroz
Gardener

Chemical Section

Roy Marquardt
Chemical Application Technologist

Protected Crop Development Section

Mohyuddin Mirza
Head, Protected
Crops Development

Kris Pruski
Tissue Culture
Specialist

Muhammad Younus
Lab Technologist

Kan-Fa Chang
Lab scientist

Sabina Pietucha
Lab Technologist

Farm Services Section

Albert Faulkner
Farm Services
Supervisor

Dave Wearmouth
Farm Services
Foreman

Dave "Steve" Milne
Irrigation
Technician

Kevin Thorpe
Gardener

Machine Maintenance

Brian Petherbridge
Mechanical
Maintenance Chief

Stan Bootsma
Auto Mechanic

Gerhard Dames
Welder

Paul Gervais
Auto Mechanic

DIRECTOR'S REPORT

The Centre continued the evolution from a production and extension unit to one of production, extension and research. Many staff members were given the opportunity to broaden their knowledge with many secondment and training sessions.

We continued to privatize many of our production and service functions with an increasing number of greenhouse nuclear seed growers and a larger number of trees and shrubs for the shelterbelt program going out to tender. There has also been a move to contract out the growing of vegetable transplants required for demonstration and research projects.

All aspects of the horticulture industry had a productive and rewarding year in 1990. The seed potato production was up nearly 10,000 tonnes over 1989 with one less grower and a 10% increase in acreage. The greenhouse industry expanded into tree seedling growing on contracts given by Alberta Forestry, Lands and Wildlife.

The commercial vegetable industry held relatively stable in 1990 with a 1% increase in acreage and dollar value. The Market Gardener acreage and dollar value held to 1989 figures. In total the commercial, market garden and processing industries did about 13.95 million dollars of business in 1990 on approximately 4130 ha (10,200 acres).

The Tissue Culture lab continued the production of saskatoon, sour cherries, chrysanthemums and other worthwhile crops. New selections of sour cherries will be available to greenhouses in early 1991.

Nursery growers suffered losses of nursery stock in the spring of 1990 depending on the location some were more severe than others. The Centre supplied 1000 wild roses and 500 trembling aspen seedlings to Alberta Road in Hokkaido, Japan. Demonstration shelterbelt planting accounted for a distribution of 27000 plants. Over 1.3 million plants were distributed in 1990.

Research continued on potato diseases that affects the seed growers, particularly black scurf and stem canker. A saskatoon disease that affects the industry severely, leaf and berry spot blight, was worked on. Vegetable cultivar evaluation took up most of the vegetable research time. Grower co-operative vegetable trials were increased into the Peace River and Red Deer areas. Greenhouse research continued on problems surrounding hydroponic vegetable growing and greenhouse cut flower production.

Tissue culture research was expanded to include conifers after porcupines ruined over half of our selected scots pine trees. As well, autotrophic micropropagation was worked on in the lab. Research in woody plant testing continued with several recommendations being made from the Regional Woody Plant Test Program in 1990. Recording soil moisture and crop yields as affected by shelterbelts continued throughout the province.

The Master Gardener Program was begun in earnest in 1990. Betty Vladicka provided excellent leadership in developing the program as a pilot project from inception to the initial training sessions. This first group will ultimately provide the nucleus for the continuation and expansion of the Master Gardener Program.

The Centre continued the publication of three production newsletters, which have been requested by growers, administrators and researchers throughout the world. We were active in several production and non-commercial courses and workshops in several Alberta communities.

Our Farm Services, administrative and lab staff gave the Centre strong able support. Little down time or loss time was experienced.

George Grainger
Director
The Alberta Tree Nursery &
Horticulture Centre

HORTICULTURE CROP DEVELOPMENT SECTION

The Horticulture Crop Development Section is made up of the Vegetable, the Seed Potato, the Horticulture Extension and the Micropropagation Pathology programs. Presently this section is operating with 5 permanent, 2 temporary salaried and 9 temporary wage staff. In addition this year we had one STEP position.

Seed Potato Program - Jim Letal

One of the major emphasis for the Alberta Seed Potato Program is to encourage and assist in the privatization of nuclear and pre-elite seed potato production. In 1989 one grower constructed a greenhouse for producing nuclear seed potatoes. This year a second grower constructed a greenhouse. In addition this grower also constructed a small tissue culture laboratory. So far these greenhouses have been very successful in producing their own nuclear seed potato tubers. In the future the move towards privatization will continue. Because of the grower commitment to producing higher classes of seed potatoes plans are to discontinue field production of pre-elite and elite I seed potatoes at Alberta Tree Nursery & Horticulture Centre. Nuclear seed production will be maintained to supply seed stocks not available from growers and also maintain backup stocks in case of crop failure at the grower level.

Table I lists our nuclear, pre-elite and elite I production for 1990. This production is similar to 1989 except for an increased volume of nuclear Shepody and Atlantic to compensate for losses experienced in the Lacombe area due to flooding this spring. In addition a new cultivar, Frontier Russet, was introduced. This cultivar is presently in high demand in the industry.

TABLE I

1990 SEED POTATO PRODUCTION

Cultivar	Nuclear (tubers)	Pre-elite (tubers)	Elite I (kg)
A74117-9	84	-----	----
Alpha	240	-----	----
Amisk	4,000	4,000	300
Atlantic	10,000	3,500	----
Banana	300	-----	----
Bintje	300	-----	----
Carlton	780	140	----
Caribe	170	50	----
Cherokee	-----	300	----
Conestoga	5,200	2,500	----
Desiree	225	-----	----
Eramosa	930	2,000	----
F27004	130	-----	----
F76080	110	-----	----
Frontier Russet	1,330	-----	----
Jemseg	-----	-----	14
Kennebec	250	-----	----
Min 9632	130	5,500	1,200
Monona	2,460	1,300	50
Niska	4,260	1,900	----
Nooksak	244	-----	----
Norchip	17,600	3,000	----
Norgold Russet	140	200	----
Norland	2,380	1,000	----
Purple Viking	200	-----	----
Red Pontiac	300	-----	----
Russet Burbank	17,000	33,000	10,000
Russet Norkotah	3,300	1,400	----
Saginaw Gold	100	-----	----
Sangre	3,000	-----	90
Shepody	12,700	1,000	----
Superior	900	1,300	----
Viking	300	300	----
Warba	85	400	----
Wisc 74-7	100	-----	----
Yukon Gold	400	250	----
Totals	89,644	63,040	11,654

TABLE II

ALBERTA SEED POTATO PRODUCTION AND EXPORTS

1965-1990

(Shipped spring of 1990)

CROP YEAR	NUMBER OF SEED GROWERS	SEED AREA (hectares)	PRODUCTION (tonnes)	EXPORTS (tonnes)
1965	59	1,033	16,773	265
1966	61	1,363	27,273	1,720
1967	53	1,220	19,636	145
1968	50	1,065	25,318	960
1969	42	1,165	17,591	1,992
1970	46	1,202	26,409	591
1971	45	1,216	18,091	185
1972	32	943	15,455	175
1973	26	672	13,091	1,530
1974	23	669	12,727	1,395
1975	24	620	12,000	2,200
1976	18	222	4,636	0
1977	16	512	6,909	78
1978	13	561	9,955	210
1979	14	466	10,455	414
1980	15	483	13,455	3,258
1981	19	593	13,273	3,630
1982	18	739	14,136	4,249
1983	23	971	21,818	6,228
1984	33	1,295	22,500	9,514
1985	37	1,675	30,310	10,488
1986	37	1,792	36,838	11,258
1987	35	1,619	45,000	14,289
1988	32	1,594	46,057	17,223
1989	32	1,932	48,303	19,539
1990	31	2,067	58,619	-----

TABLE III

SEED POTATO EXPORT SHIPMENTS*
1989 CROP YEAR
(Shipped spring of 1990)

STATE	VARIETY	# OF SHIPMENTS	TONNES
CALIFORNIA	YUKON GOLD	1	18.90
IDAHO	ATLANTIC	4	81.14
	BANANA	2	0.46
	NORKOTAH	7	143.04
	RUSSET BURBANK	28	582.85
	SHEPODY	12	244.32
			1,070.79
NORTH DAKOTA	NORCHIP	4	85.94
OREGON	ATLANTIC	21	440.47
	NORCHIP	16	324.76
	NORKOTAH	14	278.99
	RUSSET BURBANK	127	2,582.39
			3,626.61
WASHINGTON	ATLANTIC	9	196.12
	NORCHIP	22	456.00
	NORKOTAH	26	540.03
	RUSSET BURBANK	476	9,660.97
	SHEPODY	182	3,719.67
	YUKON GOLD	9	182.95
			14,755.74
		TOTAL	**19,539.08**

*This information was obtained from Agriculture Canada

Export sales of seed potatoes continued to increase (see Table II and III). In the spring of 1990, 19,539 tonnes of seed potatoes were exported to the U.S.A.

Research - Jim Letal and Piara Bains

Control Of Stem Canker and Black Scurf of Potato caused by *Rhizoctonia solani*.

Stem canker and black scurf caused by *Rhizoctonia solani* Kühn (teleomorph *Thanatephorus cucumeris* (Frank) Donk), is a serious and wide spread disease of potato. The disease causes financial losses to potato growers by reducing yields and by inducing the production of deformed and black scurfed potatoes. Seed potato growers suffer further losses due to down grading of seed potatoes. Keeping the disease under control, is also important toward maintaining Alberta's reputation as a quality seed potato producer.

A study was conducted to evaluate the efficacy of various fungicides to control the disease. Inoculum for the experiment was prepared by growing a virulent Alberta isolate of *Rhizoctonia solani* belonging to AG-3, on sterile rye grains. The inoculum was introduced to the soil by placing the infested rye grains just above the tuber seed-piece during planting. The fungicides used as tuber seed-piece treatment included benomyl, captan, iprodione, mancozeb, metiram, pencycuron, and thiophanate-methyl. The plants were evaluated for emergence, tuber numbers and yield. Some fungicidal treatments showed phytotoxicity but none of them improved tuber number and yield over inoculated control. Similar experiment with some additional fungicides will be conducted this year.

Increased Tuber Production from Micropropagated Seed Potato Plants Grown Under Greenhouse Conditions.

Greenhouse production of tubers from micropropagated potato plants is an integral aspect of the Alberta seed potato program. Some established grower greenhouses have started producing such tubers and the indications are that the trend will continue. In order to reduce the cost of production it is important to produce higher number of tubers per unit area. To achieve this objective we conducted a preliminary experiment using various plant growth regulators including ancymidol, chloromequat, daminozide, paclobutrazol, triadimeton, and uniconizole. None of these plant growth regulators, used alone, produced the desired results. Experiments are being planned to evaluate the effect of the age of the micropropagated plants (manipulated by using growth retardants), temperature, and tuber inducing chemicals isolated from potato plants, alone and in combination with plant growth regulators, on tuber production.

Micropropagation Pathology - Piara Bains

The micropropagation program involves research on diseases of important crops of Alberta and disease indexing of micropropagated plants.

Disease indexing part of the project includes *in vitro* maintenance of about 320 nuclear mother plants of 40 varieties of potatoes in a disease free state. The plants are maintained by periodic transfer of stem cuttings to fresh culture medium. At the time of the transfer the plants were indexed for diseases. Indexing for potato virus S (PVS), potato virus X (PVX), and potato leaf roll virus (PLRV) was done by the ELISA technique, potato spindle tuber viroid was done by nucleic acid hybridization technique, and

fungal and bacterial infections by *in vitro* culturing techniques. In addition to this 100,000 greenhouse-grown potato plants were also tested for PVS and PVX.

Micropropagation Pathology Research - Piara Bains, Zvezdana Pesic-Van Esbroeck, Vikram Bisht, and Jim Letal

A Study of Common Leaf Spot, Blight and Berry Spot of Saskatoon Caused by *Entomosporium mespili* (Dc ex Duby) SACC:

Commercial production of saskatoon berries is becoming popular in western Canada. There are approximately 700 acres of saskatoon in Alberta and out of these, 125 are of producing age. Common leaf spot, blight and berry spot of saskatoon caused by *Entomosporium mespili* was a disease of minor importance until 1990, when it caused a havoc with the crop in central and northern Alberta resulting in large economic losses to the growers. A preliminary survey of the disease conducted this year in five saskatoon orchards in central Alberta, had indicated a 100% disease incidence (table 1). Infection of berries was very prevalent. Racemes with 100% of the berries infected were frequently observed. Berry infections first observed in early June caused shrivelling, disfiguration, discoloration, cracking and the abundant presence of conidia on the berry surface (figure 1). Diseased leaves (figure 2) and berries collected during surveys were used for isolations of the fungus. *Entomosporium mespili* is a very slow growing fungus. Various culture media were tested for supporting growth of this fungus. A culture medium containing Saskatoon leaf infusion supported good growth in a shorter time period. Various isolates of the fungus were obtained using this medium and single spore isolation technique. Further studies on the disease are continuing.

Table 1. Incidence and Severity of Common Leaf Spot, Blight and Berry Spot of Saskatoon in Central Alberta in 1990.

Orchard No.	No. of bushes surveyed	Incidence (%)	Severity (% of berries and leaves infected per category)									
			0**		1		2		3		4	
			B	L	B	L	B	L	B	L	B	L
1	23	100	0	0	0	0	0	0	13	0	87	100
2	27	100	0	0	18	4	26	11	30	48	26	37
3	108	100	*	0	-	22	-	42	-	19	-	17
4	97	100	-	0	-	0	-	0	-	4	-	96
5	25	100	-	0	-	20	-	28	-	32	-	20

B and L represent berries and leaves, respectively

* Berries were not available

** 0 = No disease, 1 = 1-25%, 2 = 26 - 50%, 3 = 51 - 75%, 4 = 76 - 100%

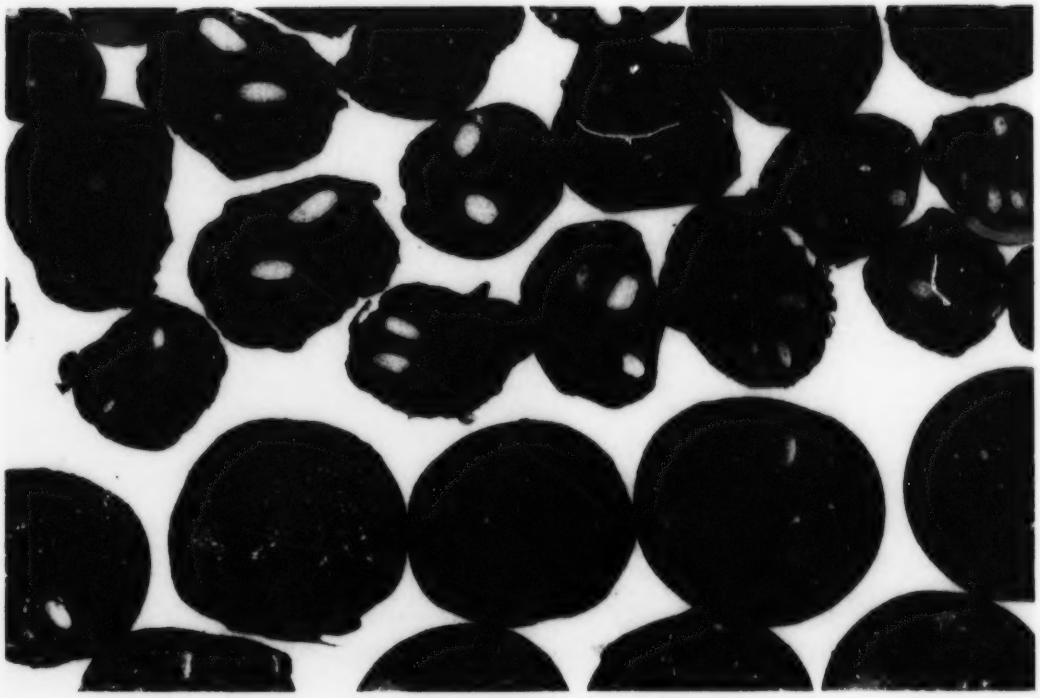


Figure 1. Saskatoon berries; upper - shrivelling and disfiguration due to *Entomosporium mespili* infection, bottom - healthy berries.

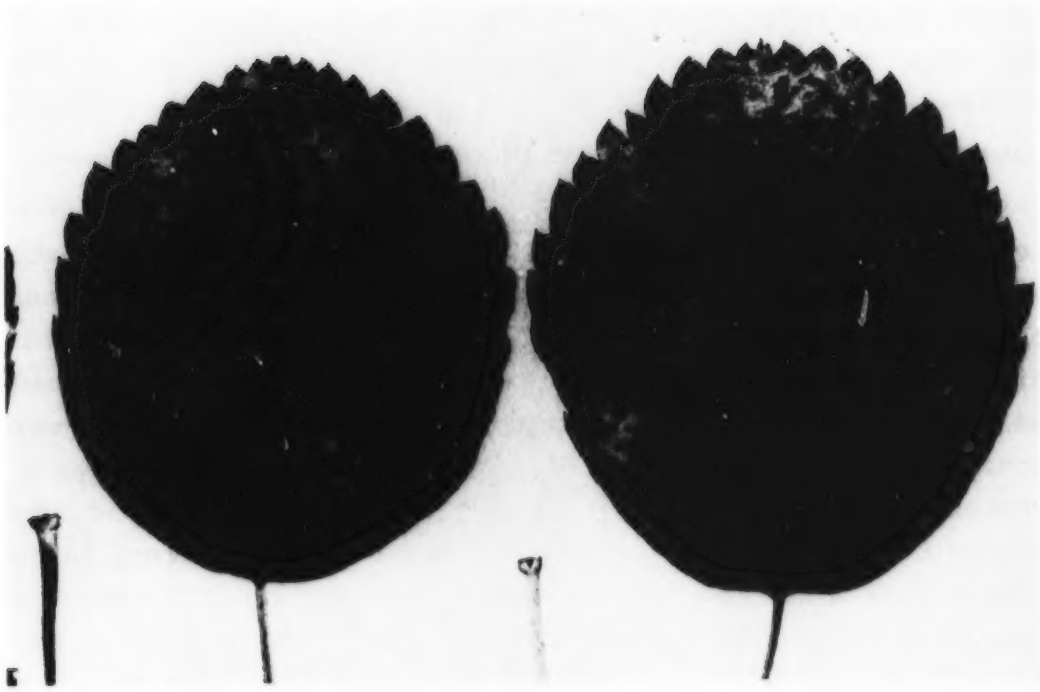


Figure 2. Saskatoon leaves showing chlorosis and necrosis caused by *Entomosporium mespili* infection.

Double Infection of Alstroemeria with Viruses:

Due to its good keeping quality and low energy requirements alstroemeria is becoming an important flower crop in Alberta. A survey of alstroemeria plants grown in a central Alberta greenhouse indicated that the plants could be infected with a virus. The plants showed mosaic and concentric chlorotic rings on leaves (figure 3), and necrosis of older leaves and stems. Indicator plants inoculated with crude sap from diseased alstroemeria plants showed chlorotic local lesions on *Chenopodium amaranticolor, C. quinoa, Gomphrena globosa*, and *Nicotiana glutinosa*, and systemic infection on *N. tabaccum* cv. Samsun, and *N. glutinosa*. Electron microscopic examination of the negatively stained preparations of leaf sap revealed the presence of flexuous rods and spherical virus particles. In addition, electron microscopy of thin sections of infected leaf tissue showed pinwheel inclusion bodies, characteristic of potyvirus group, as well as enveloped spherical particles of about 75-85 nm in diameter (figure 4). Symptoms on indicator plants, and electron microscopic studies suggest that the spherical and flexuous particles belong to tomato spotted wilt virus and a member of poty virus group, respectively. Immunogold labelling electron microscopy confirmed tomato spotted wilt virus, whereas, characterization of the poty virus is in progress.

Figure 3. Chlorotic ringspots induced in alstroemeria leaves by tomato spotted wilt virus.

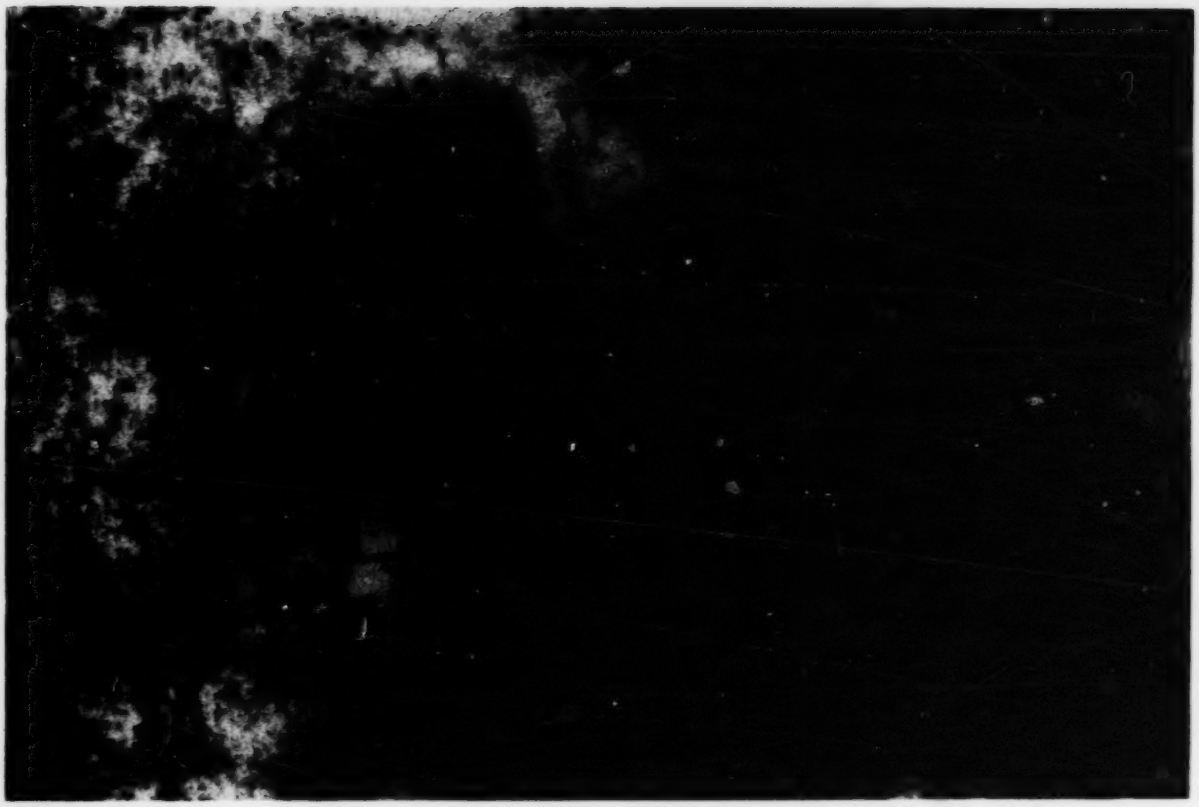


Figure 4. An electron micrograph showing spherical particles of tomato spotted wilt virus, and flexuous rod particles and pinwheel inclusion bodies of a potyvirus.

Studies on Alberta Isolates of Erwinias Causing Blackleg and Softrot of Potatoes:

Initiated a research project on blackleg of potato caused by *Erwinia carotovora* subspecies at the Interdisciplinary Research Unit of O. S. Longman building. Blackleg and softrot of potatoes, caused by *Erwinia carotovora* subsp. *atroseptica* and *carotovora* are diseases of economic importance to the growers. Thirty isolates of the bacteria were isolated using crystal violet pectate medium, from diseased plants and tubers collected from central and southern Alberta. The bacterial isolates exhibit significant variability in aggressiveness of causing softrot in potato tuber, tuber slices and carrot slices. Preinoculation incubation of tubers for 24 hours at 100% RH and 15°C, significantly increased the diameter of the rot and the amount of rotted tissue. Detached stem pieces, inoculated at the leaf axil and incubated at 15 to 18°C in test-tubes containing 1 to 2 ml of water, developed consistently uniform blackleg symptoms than that of stem inoculation of plants kept in growth chamber at 15 to 18°C and above 90% RH. Experiments to find out the correlation, if any, between tuber/slice rot and blackleg symptoms are planned.

Studies on Stem Canker and Black Scurf of Potato in Alberta:

Stem canker and black scurf caused by *Rhizoctonia solani* kühn is a wide spread disease of potato affecting yield and quality of potato tubers produced. In 1988, plants showing symptoms of the disease were collected from central and southern Alberta. Sixty-eight isolates showing characteristics typical to *R. solani* were identified as *R. solani* and hyphal tip cultures of these isolates were established. The isolates showed variation in their cultural characteristics, including rate of growth, colony colour and morphology, and number and size of sclerotia produced. Anastomosis group (AG) identification was determined by

anastomosis, and colour reaction on Stewart's medium. Of 68 isolates tested, 59 belonged to AG-3, 6 to AG-5 and 3 to AG-4. Although frequency of AG-3 occurrence was similar in central and southern Alberta, AG-5 was more frequent in central (5) than southern (1) Alberta. Analysis of pathogenicity test results will indicate the relative importance of various anastomosis groups in disease development in Alberta.

Homodestruxin B, a Nonhost-Specific Toxin Produced by *Alternaria brassicae* (Berk.) SACC.

The black spot caused by *Alternaria brassicae* is an important disease of rapeseed in Western Canada. The fungus produces destruxin B, a toxin that is host specific and a factor in disease development. (Ayer & Pena-Rodriguez, 1987. J. Nat. Prod. 50: 400-407; Bains & Tewari, 1987, Physiol. Mol. Plant Pathol. 30:259-271) Homodestruxin B, another metabolite produced by the fungus (Ayer & Pena-Rodriguez, 1987. J. Nat. Prod. 50: 400-407) also caused chlorosis and necrosis in detached leaves of *Brassica napus* cv. Westar, suggesting that it also acts as a phytotoxin. The reaction of plants, nonhost to *A. brassicae*, was variable. Some of the plants reacted with severe chlorosis and necrosis, whereas, others showed no visible chlorosis or necrosis. The results suggested that homodestruxin B is a nonhost-specific toxin perhaps contributing to the virulence and not to the pathogenicity of *A. brassicae*. Although specific activity of homodestruxin B was found to be similar to that of destruxin B, it is produced in much smaller quantities by the fungus than destruxin B.

Development of a Simple and Inexpensive Medium for Micropropagation of Potato:

Increasing number of potato seed growers are establishing laboratories for *in vitro* multiplication of pathogen-free nuclear seed potato plants. To reduce the cost of multiplication, a plant culture medium was developed using inexpensive over the counter products. The medium supported plant growth similar to the one supported by a medium prepared using large number of expensive chemicals.

Horticulture Extension - Betty Vladicka

This area provides an extension program geared at agribusinesses and consumers. The delivery of information and services is provided on a province wide basis.

There was a heavy demand for the telephone information service during the summer months. The number of inquiries was up slightly in 1990 (Table 1.1). Demand continued to be high for the hortline (a pre-recorded telephone message) and the basic plant diagnostic service. This year's callers were more environmentally aware as evidenced by the increased number of inquiries on composting and non-chemical control procedures for insect pests.

Horticultural courses were offered again through the district offices of Field Services. Three courses per region were offered covering the topics of farmstead planning, hobby greenhouses, fruit production, pest management and vegetable gardening. Extension staff also conducted seminars and workshops for horticultural societies, farm women's organizations, Alberta Recreation and Parks, and LANTA.

Mass media channels continued to be utilized. Staff provided interviews for Call of the Land and commercial radio stations across the province; submitted articles for Agri News and several weekly newspapers; and revised several departmental factsheets. Publication distribution jumped dramatically in 1990 because of the bulk distribution of newly revised Horticulture Guides.

This section liaises with other departments and provides support for several horticultural organizations. The extension horticulturist is an ex-officio director of the Alberta Horticultural Association and provided assistance with their administration, edited their publication "The Alberta

Horticulturist" and served as the education program co-ordinator. This individual was also on the Board of Trustees of the Friends of the Devonian Botanic Garden and on the executive of the Western Canadian Society of Horticulture.

The office continued to administer two grant programs. One program provides assistance to municipalities who offer a horticulture information service. The second program provides assistance to the AHA who in turn assist the various horticultural societies across the province.

1990 saw a pilot Master Gardener program being initiated. The Master Gardener program is a voluntary educational program designed to meet the gardening needs of a community. Its specific aim is to provide information and technical assistance in the areas of horticulture to the backyard gardener through the use of trained volunteers.

To become a Master Gardener participants must complete a training program, pass an examination, and volunteer a number of hours of public service through an extension office.

During the summer months, soliciting of volunteers was done through the local garden centres. Ten of the applicants were selected to proceed through the training program which began in the fall and will be completed in the spring of 1991. These individuals will then assist Horticulture Extension during the summer and autumn of 1991. The future of the program will be determined after an evaluation of this pilot project.

Table 1.1 Horticulture Extension: Statistics for 1990

	Telephone Inquiries	Hortline Calls	Soil Reports	Office Visits	Plant Samples	Publications
January	160	154	3	2	--	1820
February	120	158	4	--	--	3385
March	265	197	3	3	4	4050
April	485	310	12	8	6	41950
May	955	453	77	20	22	3440
June	925	273	26	31	35	1110
July	810	566	20	47	57	970
August	805	314	29	46	70	600
September	635	298	40	14	17	535
October	445	190	13	4	9	520
November	180	134	54	1	--	780
December	75	43	--	--	--	1230
TOTAL	6020	2682*	281	176	220	60,390

*Equipment was not always in operation.

Vegetable Program - Belinda Choban

The vegetable program at the Alberta Tree Nursery and Horticulture Centre (ATN&HC) includes both applied field research and industry extension activities on production of fresh vegetables. The program serves a growing vegetable industry of more than 300 market gardeners and commercial producers in central and northern Alberta. The ultimate aim is to increase the skill and knowledge of vegetable producers so they may increase their farm income and continue the development of the fresh vegetable industry in Alberta.

The staff consisted of two permanent employees, Belinda Choban, vegetable program head and Dominique Bizon, vegetable technologist. In addition three summer employees conducted the field research trials.

Extension:

Extension activities focused on educating and transferring technology to growers and all aspects of vegetable field production including post harvest handling and preparation of product for the fresh market sales. To a limited extent marketing assistance in regards to buyer contacts, buyer awareness and market needs and consumer trends was also provided.

This year's extension activities included on-farm extension visits, one-to-one grower communication by telephone and grower visits to the office. Growers were reached by a quarterly newsletter "Produce Notes" which is distributed to 500 people including growers, wholesale produce buyers, farmers' market managers, industry, government and out of province specialists. Information was also provided through various tours, seminars and courses including a two day beginner market garden course, one day seminar

on direct marketing, an equipment demonstration day, a two day seminar on research trial results, a province wide wholesale produce buyer tour, vegetable grower tour, growers' social night and a growers' field day/barbecue.

Forty-four growers were assisted with fertility recommendations and 19 on farm equipment demonstrations were conducted. Thirty new grower inquiries were handled. The vegetable specialist worked closely with five growers in producing high quality transplants for their fields.

Close liaison with the vegetable industry was maintained through contact with such organizations as the Alberta Special Crops and Horticultural Research Center in Brooks, the Alberta Fresh Vegetable Marketing Board, the Alberta Market Gardeners Association, the Northern Fresh For Flavor Foundation, the Alberta Vegetable Advisory Committee and Sun Fresh Farms Marketing Co-op. Liaison was further enhanced by regular visits to wholesale produce buyers and farmers' markets, and through regular contact with industry equipment dealers and supply companies.

The vegetable specialist was actively involved in the 4th annual Alberta Horticultural Congress and presented two talks. She also organized fresh vegetable donations and the planning of activities to promote consumer awareness of availability of local vegetable production through the annually held Fall Harvest Festival.

Co-operation and assistance was provided to the other government departments and agencies. ADC loan proposals for prospective growers were reviewed. Production data was supplied to Alberta Hail and Crop Insurance to assist them in establishing an adequate vegetable crop insurance plan. Assistance was also provided to growers and Alberta Emergency Disaster Aid in the assessment of hail and flood damage for crops for ten growers.

Trial Work:

Research was done on cultivar evaluation and production technology and was aimed to improve crop yields, quality and earliness. Research was guided by industry demand and market information. It was done on crops that were of greatest economical importance to the industry in central and northern Alberta. Research results and analysis were published in the ATN&HC pamphlet #90-V01 entitled "Vegetable Cultivar and Cultural Trials."

1) Cultivar Evaluation on 30 cabbage, 18 cauliflower, 8 broccoli, 13 Chinese cabbage, 21 sweet corn and 13 cos lettuce was done. All were evaluated for yields, quality and maturity. In addition, cole crops were evaluated for a) cold soil seed germination, b) transplant versus direct seed production, c) transplant tolerance to frost, d) storage quality and e) expansion of market period through scheduling of appropriate seeding periods.
The new promising cultivars will be evaluated for three years before recommendations are given to the industry.
Storage trials were done in co-operation with Paul Ragan, ASCHRC, Brooks.

2) Production evaluation was conducted on the following:

a) Broccoli and Carrot Fertility Cultural Trial:
Broccoli and carrot were evaluated for yield and quality under several application rates of combined nitrogen and phosphorus fertilizer. The trial was done in co-operation with the Seed and Feed Testing Lab.

Fertility levels appear to be of lesser importance in influencing yields in carrot production than other factors. Soil moisture

levels, plant population density, seed placement and seed bed preparation are of equal or greater importance in carrot production.

Quality broccoli appears to be greatly influenced by fertility levels. Results indicate that a good quality product and high yields require approximately 250 to 300 kg/ha total nitrogen and 150 to 200 kg/ha total phosphorus.

b) Transplant Nutrient Deficiency Trial.

Transplants of cabbage cauliflower and broccoli were grown under fertilizer regimes deficient in either nitrogen, phosphorus or potassium. The stressed transplants were grown in co-operation with the Greenhouse program and then field set.

Despite the relatively high level of nitrogen in the soil, deficiency of nitrogen during transplant growth was most important in influencing plant growth and yield. Potassium and phosphorus deficiencies had only minor effects and in some cases treatments were equal or better than the control.

Nitrogen deficiency severely delayed maturity in broccoli and reduced both head size and weight in both cauliflower and cabbage. Unfortunately, all plants were severely stressed due to lack of moisture just prior to field setting. This may be the reason for the lack of uniformity observed in all trials, particularly for cabbage.

In conclusion, it is clear that nitrogen applications during transplant production should be carefully monitored. Phosphorus and potassium appear to be less influential, and deficiencies of these during transplant growth may not seriously reduce product quality or yield.

3) A Grower Co-operative trial was conducted in Peace River to evaluate 22 cabbage and 21 sweet corn cultivars for yields, quality and earliness. The grower co-operative trial was very successful and several new promising varieties will be evaluated again next year.

4) A Farm Demonstration trial was conducted in Red Deer. Baby carrots were precision seeded at various seed spacings and planting dates and evaluated for crop yields and quality. Spring floods damaged this trial but general observations were made that will enable growers in the region to increase crop yields next year.

5) In addition information and expertise was provided to the North West Territorial Growers Association with the establishment of seven grower co-operative trials.

6) Also the Edmonton site for the Potato Prairie Regional trial was managed by ATN&HC vegetable program.

PROTECTED CROPS DEVELOPMENT

Greenhouse Program - Commodity Report - Mohyuddin Mirza

Nineteen-ninety was a good year for the Alberta Greenhouse Industry. A large number of growers benefitted from the greenhouse assistance program by installing computers, fertilizer injectors and several energy saving devices.

The vegetable sector continued to perform satisfactorily. Crops on rockwool were excellent.

Tomato production remained stable. Many growers switched over to rockwool.

A large indoor spinach, lettuce and herb production facility continued to produce crops. Some production problems were overcome which were related to a sealant toxicity used in the system.

Bedding and Ornamental plant growers had a good year. The sales were good but due to cooler weather they continued into late July.

Interest in cut roses, Asiatic and oriental lilies increased considerably, with many growers experimenting with freesias and calla lilies.

The tree seedling sector expanded. The growers who produced good quality seedlings in 1989 - 90 season were given further contracts. More beginner contracts were awarded.

The Alberta Greenhouse Growers Association progressed well during 1990 and the Alberta Horticultural Congress was very successful in Calgary.

Alberta Agriculture continued to provide an extensive research and diagnostic backup to the greenhouse growers.

The Soils and Animal Nutrition Laboratory continued to provide soil and water analyses on a priority basis.

Greenhouse Extension Program:

The 1989-90 season was very busy for greenhouse extension and technology transfer. The contact with the growers was actively maintained. Following are some of the highlights:

1. Diagnostics and trouble shooting was provided on the basis of need and demand. More than 200 visits were carried out. More demand is coming from newly established alstroemeria, Asiatic, Oriental lily, rose, and tree seedling growers in the central part of the province. The problems related to diseases, insects, temperature and fertilizers.

2. A survey of diseases of cut flower crops was completed throughout the province. The results indicated the Fusarium crown and root rot was the number one disease in Alstroemeria and Asiatic lilies, followed by Rhizoctonia and Pythium fungi.

3. Nutrient tests of water, soil, hydroponic solution and other growing media continued to increase. Approximately 250 recommendations were handled.

4. Greenhouse vegetable production guide for 1990-91 was expanded to cover seedless cucumbers, tomatoes and peppers. Hobby greenhouse publication was also revised. Other publications which were updated:
   Hydroponics a Guide to Soilless Culture, Bedding Plants Production Guidelines and Poinsettia production.

5. Input was provided into greenhouse production economic survey and a survey on bedding plants cost of production was initiated.

6. Alberta Greenhouse Notes continued to be a major information transfer tool to growers within the province and outside the province.

7. Greenhouse information was provided to about 130 would be growers. Several tours were conducted at the site.

8. Evaluated projects for funding by the Alberta Agricultural Development Corporation.

9. Following courses/workshops were organized:
   Cucumber and tomato production in December 1990
   Tree Seedling Production course in December 1990
   Water Quality workshop
   Bedding Plants workshop

10. Taught a greenhouse course at the University of Alberta.

11. Supervised one M.Sc. student at the University of Alberta. The thesis subject was on the use of Fibre Optics for the Production of Greenhouse Crops in Northern Climates.

12. Participated in the activities of the Alberta Greenhouse Growers Association by being appointed on their Board of Directors.

13. Participated as a guest speaker in the Alberta Horticulture Congress and the Manitoba Greenhouse Growers Association conference.

14. Completed a study tour of greenhouses and research facilities in Holland, England, Denmark and Norway. The findings were presented at the Horticulture Congress meeting in Calgary.

15. Provided extension services to tree seedling growers in the province.

Greenhouse Research - Muhammad Younus, Kan Fa Chang and Mohyuddin Mirza.

Effect of Humate® on the Yield of Greenhouse Tomatoes.

Humate® was evaluated as a growing medium amendment to study its effect on the yields of tomatoes.

Four different levels of water soluble Humate® were incorporated to a standard soilless mix. They were 1.0, 1.5, 2.0 and 5.0 grams/Litre of the growing medium. Controls were without any addition. Six week old tomato seedlings of cv. caruso were transplanted to 20 litre plastic pots at a planting density of $2.0/m^2$ in a glass greenhouse. The plants were set up in a completely randomized design. A drip irrigation system was used to fertigate the plants. A triple-head Anderson fertilizer injection system was used to supply the fertilizer.

Data was recorded on the total yield and number of tomatoes per square meter.

Humate amendments between 1 - 2 g/L of growing mix resulted in yields of between 11.37 to 12.5 kg/m^2 as compared to 10.05 kg for control. The yield increase was highly significant. Cation Exchange Capacity was also improved with Humate additions.

An Evaluation of Thrip Population in a Cucumber Greenhouse.

Western flower thrip populations were monitored in a cucumber greenhouse after the crop was removed and the effectiveness of various control measures was studied.

Yellow and blue sticky traps were installed at ten different locations, one card/20m^2 area. The greenhouse was fumigated with Nicotine, followed by Dibrome. The temperature was raised to 40°C for two weeks and relative humidity was brought to 80% on alternate days.

The thrip population was between 153-116/100 cm^2 at the beginning of the study, it dropped to 72-17, following the fumigation and spray application. An increase occurred 253-41/100 cm^2 due to hatching and then it dropped to zero 15 days after fumigation. High temperature and alternate high and low humidities helped to reduce the thrip population.

The Effect and Control of Seedborne *Fusarium oxysporum* f. sp. *spinaciae*.

The effect of seedborne *Fusarium oxysporum* f. sp. *spinaciae* (FOS) was conducted in a hydroponic growing system. Six weeks after seeding, plant height, root length, and fresh weight of the diseased plants were reduced to 28%, 44%, and 78%, respectively, relative to healthy ones. To screen the effectiveness of fungicides to the disease, benomyl (1.25 g a.i.), polyram 7D (1 g a.i.), dithane (4 g a.i.), rovral (2.5 g a.i.), thiram (3.2 g a.i.), and captan (2.5 g a.i.) were each used to coat one kilogram of naturally infected "Tyee" seeds. None of the treatments eradicated FOS. However, the most effective seed treatments were thiram, captan, and hot water (49± 1°C for 30 min), which reduced the incidence of FOS from 76% in the untreated control to 7%, 9% and 5%, respectively, in treated seeds.

Seed Transmission of *Fusarium oxysporum* f. sp. *spinaciae*.

Infection of spinach wilt caused by *Fusarium oxysporum* f. sp. *spinaciae* (FOS) was severe in a hydroponic growing system at Spruce Grove, Alberta in 1990. Seeds from nine of 15 spinach cultivars were contaminated with the pathogen. On average, 70% of "Tyee" seed samples were infected with FOS while in a hydroponic system, 60% seedling infections with disease severity of 0.32, were detected. The pathogen occurred as conidia contamination and mycelium in the pericarp. SEM and TEM sections revealed fungal mycelium established in the inner seed coat and the endosperm but failed to detect these in the embryos. Both superficial and deep infections were equally important in the transmission of the disease. The pathogen was highly virulent to both seeds and two-week old seedlings.

Occurrence of Root Rot Disease Complex of Alstroemeria in Southern and Central Alberta.

To understand the current situation of alstroemeria root rot in Alberta, a total of eight greenhouses and 15 cultivars of alstroemeria were surveyed in June 1990.

Among the greenhouses, disease incidence (DI) ranged from 0 to 60.3% (mean = 33.7%), while the disease severity (DS) ranged from 0 to 0.53 (mean = 0.27). Among the cultivars the highest DI occurred on "Orange Monarch" (67.9%); DS was greatest in "Saxony" (0.47). Lowest DI and DS values occurred in "Paloma" (16.6 and 0.11). The most frequently isolated microorganism from the cultivars was *Fusarium* spp. (from 40.5% of plants examined); *Pythium* spp. and *Rhizoctonia solani* were isolated less frequently (5.5% and 6.8% of plants, respectively). All three microorganisms were pathogenic to *Alstroemeria* spp. and they may play a significant role in the reduction of yield, especially during warm and moist conditions.

Interaction of Root Rot Pathogens on Alstroemeria.

In recent years *Alstroemeria* spp. has become a popular cut flower in many countries. *Pythium* spp., (P. *ultimum*, P. *irregulare* and P. group "G"), *Rhizoctonia solani*, and *Fusarium oxysporum* have been isolated from diseased plants. Pathogenicity studies showed that under wet growing conditions *Pythium* spp. alone caused the highest killing effect (86%) of alstroemeria. Inoculum composed of these three pathogens killed all the plants (100%) suggesting a synergistic effect. However, any other two combinations among the pathogens may slightly reduce their disease severities.

Further studies on the control of *Pythium* with *Bacillus* in Rockwool Grown Cucumbers.

Several experiments were conducted to study the control of *Pythium irregulare* using a *Bacillus macerans* strain. Seedless cucumbers were germinated in a 2.5 x 2.5 cm rockwool cube and then soaked with *B. macerans* suspension at cell densities ranging from 10^6 to 10^9/ml. No deleterious effect was noticed on plant development.

Rockwool cubes soaked with the bacterium were transferred to 10 x 10 cm blocks inoculated with *Pythium irregulare*. A reverse sequence was carried out in another experiment whereby the smaller cubes were soaked with Pythium and bacteria applied to the larger cube. Plants died in this treatment rapidly. A significantly higher number of plants survived in the treatment whereby small cubes were inoculated with the bacteria and the larger cube with Pythium.

Effect of Potassium Silicate on the Growth of Selected Bedding Plants in a Commercial Greenhouse.

Petunias, pansies and alyssum plants were supplied with 100, 200 and 400 ppm of SiO_2 from potassium silicate, three times, one week apart in a commercial greenhouse. First application took place at 4 - 6 leaf stage of development. The plants were observed for growth and general vigour. At full maturity, no positive benefits could be demonstrated.

Nighttime Feeding of Calcium in Seedless Cucumbers.

Seedless cucumbers cv. Corona plants were manually supplied with additional calcium nitrate (30, 60 and 90 ppm Ca) around 5:00 p.m. The treatments were done three times per week. The plant health and vigour improved, the tissue calcium increased to 2.6% from 1.5% but a significant positive effect on yield could not be demonstrated. Due to lack of an automated irrigation system at night time the results are inconclusive. Further research is required in this area of calcium uptake at night time when plants are under less stress.

Product Testing:

Several products were tested for their growth enhancing capabilities. Humate® amendments to a soilless medium resulted in enhanced vields in tomatoes. The data was made available to Agriculture Canada for registration.

A fish meal preparation tested on barley did not indicate any positive effect.

Bioassays:

Several herbicide bioassays were carried out on water supplies to greenhouses. Picloram was the source of plant losses in two cases, while 2,4-D caused problems in many other greenhouses. Twenty water samples were tested.

Micropropagation - Kris Pruski

The tissue culture laboratory in 1990 continued to provide service and support to the industry. The laboratory produced 6,000 saskatoon plants for the Alberta Fruit Growers Association for production, 2,000 plants for various other groups within and outside the province and 2,000 plants for research purposes such as variety and fertilizer trials in Alberta, Saskatchewan, Manitoba and British Columbia. Some of these plants were sent to Scotland (400 saskatoons in eight cultivars) for research. Requests for saskatoon plants were received from Poland and the U.S. and plants will be sent to these countries in the spring of 1991. New cultures of all cultivars have successfully been established for 1991.

The sour cherry cultivar from Poland, Lutowka, was evaluated for its hardiness in Alberta. After the first year existing cherry orchards (planted in 1989) at Brooks, Edmonton, Beaverlodge and Fort Assiniboine survived winter in excellent condition. No frost injuries were observed and trees began active growth in the spring. During the 1990 growing season the total growth was from 38 to 65 cm. The winter 1990/91 will be critical for these trees since their newly formed crowns will be above snow cover. The lab produced another 500 trees for research purposes. There is a strong demand for Lutowka cherry among Alberta, Saskatchewan and Manitoba growers.

Meeting the growers' demands, the laboratory propagated and distributed two superior selections of pincherry; Jumping Pound received from ASCHRC, Brooks and Mary Liss received from Mr. Ted Laidlaw of Native Fruit Nurseries Ltd., Tofield, Alberta. About 200 plants were produced and new cultures for 1991 were successfully initiated.

New micropropagation project was initiated on conifers, Scots pine and Norway spruce in particular (see research section). This project is done in co-operation with Dr. Trevor A. Thorpe from the University of Calgary.

A total of 95,000 potato plantlets were produced in 1990 for greenhouse planting, this includes a special request of 16,000 extra for July planting. New cultures required for 1991 have been prepared.

Table 1. Plant material produced through tissue culture in 1990

Plant	Total number of plants
Potato	95,000
Raspberry	150
Pincherry	200
Sour cherry, Lutowka, Poland	500
Saskatoon	10,000
Total	105,850

Micropropagation Research - Kris Pruski, Mohyuddin Mirza, Sabina Pietucha

There were several research projects initiated and conducted on various aspects of micropropagation at the laboratory in 1990. They are summarized in the abstract form.

Autotrophic Micropropagation of Potato *(Solanum tuberosum)*

The autotrophic micropropagation is based on growing plantlets on the nutrient medium in the absence of sucrose and on CO_2 enriched atmosphere. The method gives possibilities of 1) reducing microbial contamination, 2) using loosely capped vessels, 3) better humidity control, 4) increasing survival percentage since plantlets do not require acclimatization.

In our studies the autotrophic micropropagation of potato cv. Russet Burbank was undertaken. Single node microcuttings were placed on MS medium ± sucrose 30g/L and incubated for three weeks in a growth room at 22/20°C d/n temperature, 16h photoperiod ± CO_2 at 1500 ppm. No significant differences were observed between control (MS + sucrose) and autotrophic plantlets (MS, no sucrose + 1500 ppm CO_2) - cultures produced 44 - 46 mm shoots with average of eight nodes. The color of autotrophically grown plantlets was lighter and their dry weigh was significantly lower. Since plantlets are then planted in the greenhouse and they regain their growth very quickly, the lower biomass should not be of major consideration. Thus, the system can also be used in potato plantlet production especially in places where the aseptic conditions are difficult to maintain. The best cultures, however, were observed on MS + sucrose with extra CO_2 (76 mm shoots with average nine nodes were produced). Addition of extra CO_2 to the atmosphere significantly improves quality of produced plantlets, thus speeds up the multiplication process.

Micropropagation of Sour Cherry ***(Prunus cerasus)***

Micropropagation of sour cherry has been investigated. Explants were taken from dormant buds from field grown plants and shoot tips from greenhouse grown plants. Cultures were initiated on WPM and MS media with 0.2 mg/l of IBA and 1 - 1.5 mg/l of BA. Both types of explants and both types of media were equally successful in initiating sour cherry cultures. Seven levels of BA in the media were tested to determine the best proliferation. The concentration of 1 - 1.5 mg/l of BA in MS medium gave the best results. Rooting of cultures performed *ex-vitro* on the greenhouse bench with bottom heat 25°C and intermittent mist.

Plantlets were rooted in roottrainers filled with deciduous soilless mixture. there was 56 - 80% rooting observed after five week rooting period.

Plants were then transplanted to 1 gallon pots and grown under standard greenhouse conditions 24/18°C day/night temperature for about ten weeks before planting to the field.

Micropropagation of Scots Pine ***(Pinus sylvestris)*****, White Spruce** ***(Picea glauca)*** **and Norway Spruce** ***(Picea pungens)***

Micropropagation of spruce and pine was investigated. Vegetative, terminal buds (from outdoor grown trees) were used to initiate cultures. Following sterilization in alcohol and bleach, meristematic tissues from buds were excised and placed on different culture media (WPM, GD and von Arnold/Erikssen) in test tubes for initiation. Explants were incubated for six weeks in a growth room at 24°C with 16 hours photoperiod at 3000 lux. Spruce explants seem to be easier for establishing since after three week period some growth activity could be observed. After six weeks small shoots started to grow from explants. More difficulties were

encountered with pine cultures. Serious contamination was observed and cultures were difficult to establish.

Developing the micropropagation system for pine and spruce (using vegetative buds as explants) might be very useful in propagating valuable specimens of these species. The project is to be continued for several years until suitable method of micropropagation will be developed.

Micropropagation of Four Cultivars of Saskatoon Berry (*Amelanchier alnifolia* NUTT.)

In vitro culture establishment, shoot proliferation, *ex-vitro* rooting and dormancy breaking of the newly rooted plantlets were examined on saskatoon berry (*Amelanchier alnifolia* NUTT.) cultivars Northline, Pembina, Smoky and Thiessen. Shoot-tip explants taken from actively growing plants were better for culture initiation than dormant buds. MS gave the most satisfactory results of the media formulations. Optimal shoot proliferation occurred at 8.8 and 13.3 μM BA. Higher BA concentrations caused culture deterioration during long-term maintenance. Auxin treatments significantly stimulated ex vitro rooting of shoots in all cultivars. The best rooting was achieved with IAA/NAA (2.8/1.1 μM) mixture (Figure 1) Satisfactory results were also obtained with commercial powder formulation, Rootone F, containing IBA/NAA mixture. Foliar application of BA and $GA_{4,7}$ was successful in breaking dormancy of newly rooted plantlets. Combinations of these two growth regulators caused formation of auxiliary shoots and vigorous plant growth. There were significant differences in the cultivar responses to culture conditions and treatments with growth regulators. The best culture establishment and the highest rate of shoot proliferation was observed in cv. Thiessen; the best rooting and the most vigorous post-dormancy growth was recorded in cv. Smoky. Cultivar Northline gave the most erratic responses.

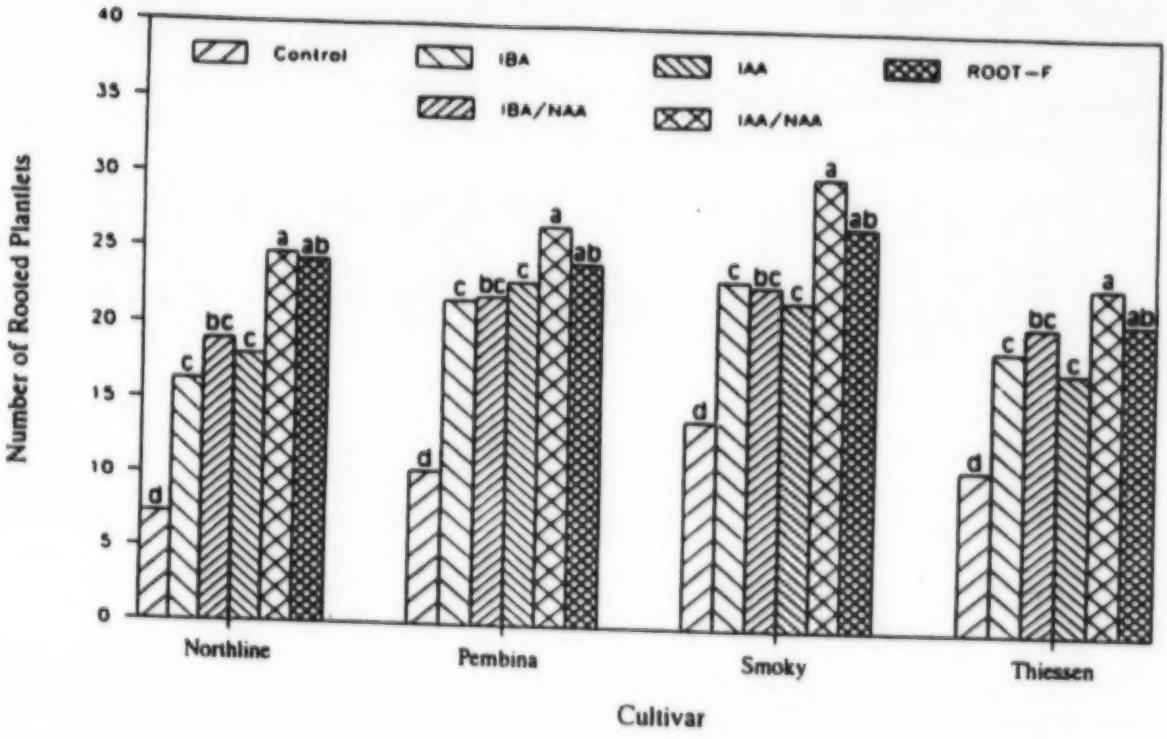


Fig. 1. Auxin effect on *ex vitro* rooting of tissue cultured derived shoots. Number of rooted plantlets was recorded after five weeks of growth; 96 plantlets (3 replicates of 32 shoots) were used per cultivar in each treatment. Means followed by the same letter are not significantly different at P = 0.05 (Duncan's Multiple Range Test).

The Effect of Gibberellic Acid on Dormancy and Rooting of Saskatoons (*Amelanchier alnifolia* NUTT.) *In vitro*

Recently the saskatoon berry became a commercial fruit crop in the Prairie Provinces of Canada. Production of high quality, uniform material is possible through tissue culture method and has been reported in literature. No major problems have been encountered with initiation and multiplication stages. Rooting and post-rooting periods, however, appear to be critical. Dormancy condition which occurs during the rooting period causes significant losses (about 50%) in propagated material. In our studies, gibberellic acid (GA_3) 0.1 μM - 2 μM was used in the rooting medium (½ MS salts containing standard vitamins, 2.4 μM of indole-3-butyric acid (IBA), 20 g/l of sucrose and solidified with 0.6% agar) to prevent dormancy of newly rooted plantlets. *In vitro* derived *Amelanchier* shoots were grown for four weeks in 24°C with 16 hours photoperiod at 50 $\mu E/m^{-2}/s^{-1}$. Dormancy condition was not observed with plants grown on media containing GA_3 at all concentrations used. Rapid elongation of shoots was observed but rooting was significantly suppressed (14% rooting with GA_3 versus control 79%, however, all rooted control plants were dormant, (Figure 2). Use of activated charcoal in the medium increased rooting to 39% and suppressed callus formation at basal portions of the shoots.

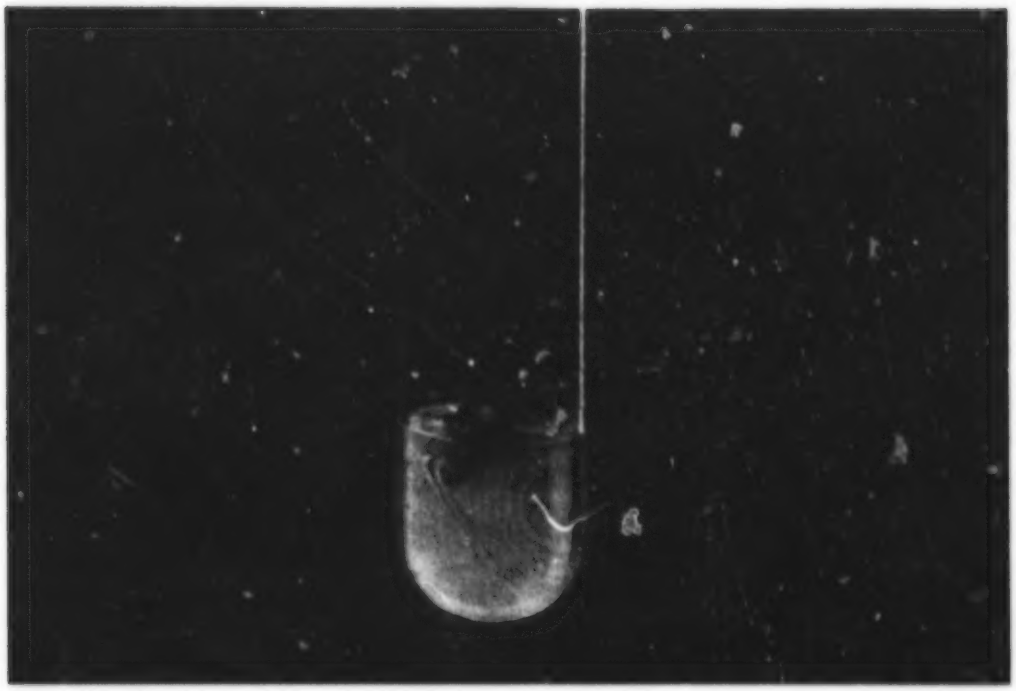


Figure 2. *In vitro* rooted saskatoon plantlet showing dormancy symptoms.

Changes in Growth Regulators' Levels in Saskatoon Plantlets during the *in vitro* Rooting Period

Endogenous levels of absicic acid (ABA) in saskatoon plantlets were measured using high performance liquid chromatography (HPLC). Quantitation of ABA was done during the *in vitro* rooting period. The data obtained from this experiment indicates that the level of ABA in plantlets increases along with the time course of rooting, being the highest at the end of the rooting period. This might explain why most of saskatoon plantlets are dormant after the rooting period is completed.

Measurements of gibberellins and cytokinins will be performed in near future. Once data will be available explanation of post-rooting dormancy stage in saskatoon plantlets might be possible. Project was done in co-operation with the Food Science Department, University of Alberta which provided HPLC apparatus and scientific expertise.

NURSERY CROP DEVELOPMENT SECTION

Commodity Report - Brendan Casement

The Ornamental Horticultural Industry in Alberta has seen improved health and stability in recent years with the improvement and stabilization of the economy of Alberta. However, some nurseries experienced losses in the spring of 1990, especially in the thin barked types of plants. Small caliper apples seemed to be the most affected, and it appeared to be due to cold desiccating winds in early spring.

The Alberta Tree Nursery and Horticulture Centre supplied 1,000 wild roses and 500 trembling aspen seedlings for the 'Alberta Road' project in Hokkaido, Japan.

The Australian willow was well advertised again in 1990, and there were a fair number of enquiries. An article about them was published in 'Alberta Nursery Notes' and this was reprinted in the 'Prairie Landscape Magazine'. Any above ground growth of these plants has not proven hardy.

Acute leaf willow was added to the list of plants available for field shelterbelts through the Canada/Alberta Soil Conservation Initiative, making a total of six.

Shelterbelt Production - Brian Breneman, Rulie Bok

Distribution Summary - 1990

1) **Shelterbelt Program** (Actual Number of Plants)

	Applications	Tall Deciduous	Small Deciduous	Hedge	Evergreen	Conservation Bundle	Total
Lethbridge	770	53,600	12,700	132,400	23,990	2,160	224,850
Calgary	760	67,625	11,375	214,050	27,220	2,500	322,770
Red Deer	723	82,375	5,800	70,450	35,330	2,300	196,255
Vermilion	740	72,550	6,675	62,275	34,530	2,340	178,370
Barrhead	440	66,975	9,125	28,175	25,740	1,400	131,415
Fairview	444	40,475	5,750	35,450	14,660	2,320	98,655
Total	3,877	383,600	51,425	542,800	161,470	13,020	1,152,315

(456,100 plants were distributed for field shelterbelts to 332 farmers through the Canada-Alberta Soil Conservation Initiative)

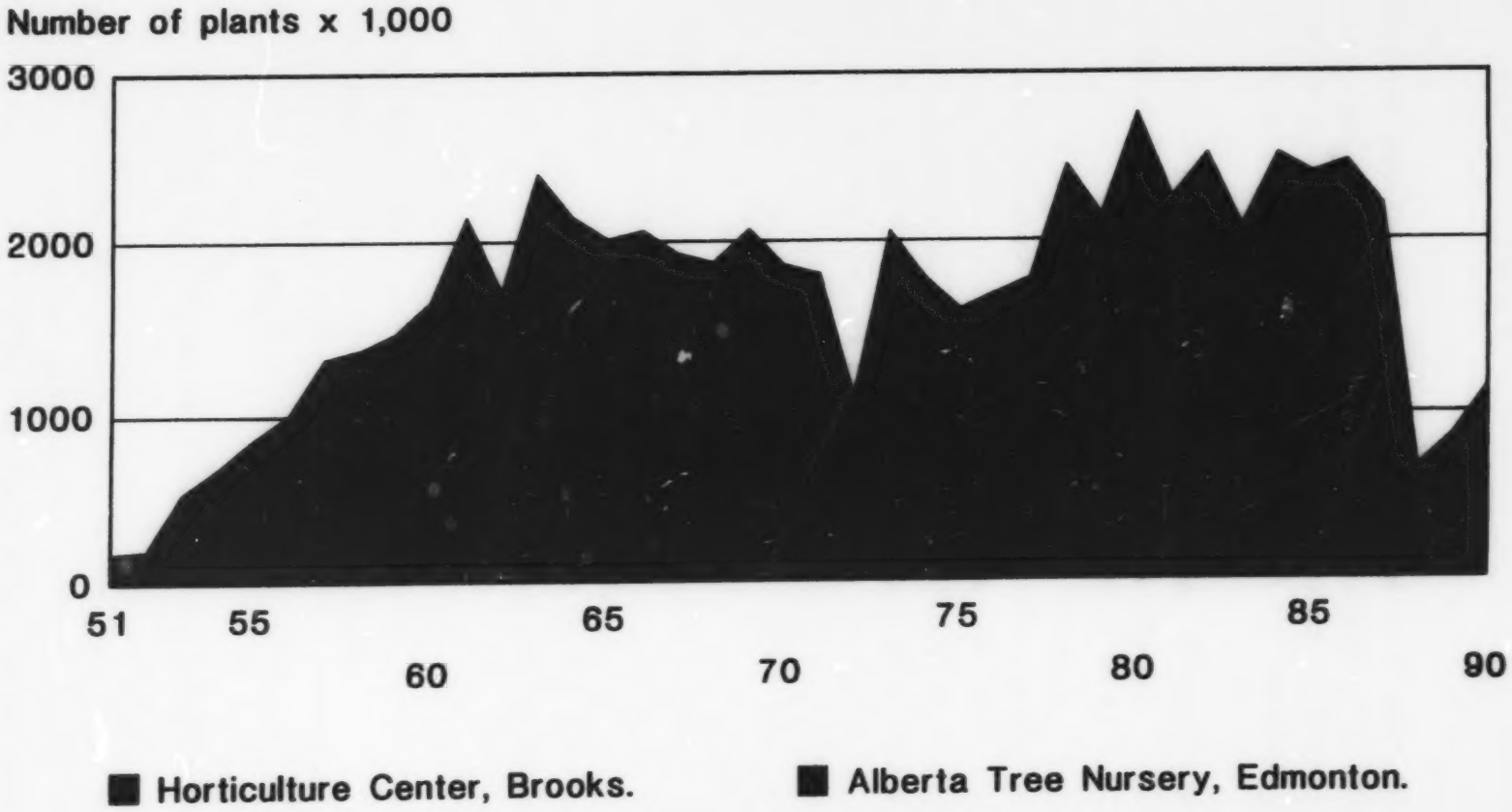
2) **Miscellaneous**

Demonstration shelterbelts	26,805
Fish and Wildlife plantings	60,225
Arbor Day seedlings	54,000
Surplus Sale	52,500
Parks Plantings	14,500
Forestry	2,500
4-H bundles	800
Replacements for lost plant	3,985
Total	215,315

3) **Grand Total of plants distributed in 1990** - 1,367,630.

Fig 1., shelterbelt plants distributed between 1951 and 1990.

Fig. 1. Shelterbelt Distribution: 1951 - 1990 Production from the Provincial Institutions for Shelterbelts.



The weather during the 1990 growing season was uncooperative, ranging from very wet in early June to hot and windy in August. This caused scheduling difficulties for the planting of cuttings and seedlings, and weeding problems on all plants.

Between January and March 1.3 million cuttings of poplars and willows were processed and stored. Planting took 8.5 working days, but over a four week period because of wet field conditions. This also affected the effectiveness of the herbicides applied to control weeds. Only 225,000 cuttings were graded out for shipping in 1990. The assembly of the orders took 10.5 working days in late April and early May, with the last shipments being made to the Peace River Region on May 22, 1990. Some problems in shipping codes developed in Regions I and II, and plants were shipped to the wrong destinations, the destinations of the rest of the orders were checked and corrected when necessary.

The transplanting of the 531,000 conifers started on schedule on August 1 and took 12 working days. However, this was spread over six weeks because of the strong winds and high temperatures early in August, and heavy rains late in the month. Over 18,000 meters of seedbeds were sown to 22 species of trees and shrubs during the summer and fall of 1990.

Despite late frosts and consequent late leaf drop, harvesting started on September 24, and was completed on October 25, with good weather. Grading continued through November with 1.38 million deciduous plants being graded out and placed in storage.

Container Production - Cecilia McIsaac

During the winter 745,000 spruce seedlings were grown in the greenhouses and moved to the lath houses at the end of May. In June the greenhouses were 'loaded' with pine, larch and birch, which

were removed at the end of August and placed in the lath houses. Most of these seedlings are for the shelterbelt program or contract growers, some for Arbor Day and the rest for the Parks Program.

Provincial Parks received 15,278 containerized plants for the parks throughout Alberta in 1990. This is about twice as many as last year, and more in keeping with the production aims.

Seed Collection - Simone Dalpé

The 1990 season was fairly productive with excellent crops of villosa lilac, cherry princepia, Mongolian cherry, chokecherry, sea buckthorn and white spruce. Some of the poorer producers were Nanking cherry, white birch, Mayday and Colorado spruce. Others such as Albol currant, Norway spruce and Russian olive, are difficult to collect in the Edmonton area as there are insufficient seed sources at present. Insect infestations on Tartarian honeysuckle, caragana, Siberian larch and Manitoba maple reduced both the amount of fruit available and the graded seed.

Seed Collection Data 1990

Species	Collection Dates	Fruit kg	Seed kg	Fruit/Seed Ratio
Saskatoon	17/07 - 31/07	164.0	4.240	38.7:1
Mayday	19/07 - 01/08	270.5	40.553	6.7:1
Red Elder	25/07 - 07/08	193.5	6.887	28.1:1
Nanking Cherry	27/07 - 15/08	53.0	4.000	13.3:1
Honeysuckle	30/07 - 13/08	162.0	4.888	33.1:1
Mongolian Cherry	02/08 - 28/08	101.5	4.631	21.9:1
Albol Currant	09/08 - 04/09	13.5	0.085	158.8:1
Dogwood	15/08 - 22/08	102.0	10.500	9.7:1
Pincherry	16/08 - 17/08	11.5	1.350	8.5:1
Sandcherry	20/08 - 23/08	26.0	2.189	11.9:1
Silver Buffaloberry	20/08 - 01/10	167.5	5.191	32.3:1
Chokecherry	23/08 - 27/08	260.0	35.350	7.2:1
Sea Buckthorn	27/08 - 28/08	78.0	4.020	19.4:1
White Spruce	29/08 - 27/09	365.8	9.600	38.1:1
Cherry Prinsepia	29/08 - 17/09	201.0	43.200	4.7:1
Korean Bush Cherry	05/09 - 06/09	90.4	13.000	7:1
Norway Spruce	07/09	10.0	0.227	45.5:1
Ohio Buckthorn	10/09 - 17/09	63.5	35.500	1.8:1
Bur Oak	10/09	20.0	18.000	1.1:1
Cranberry	13/09	76.0	0.430	176.7:1
Colorado Spruce	17/09 - 27/09	58.7	0.743	79:1
Villosa Lilac	19/09 - 21/09	537.9	9.100	59.1:1
Scots Pine	20/09 - 21/10	306.3	3.480	87.8:1
Siberian Larch	24/09 - 26/09	160.5	8.325	19.3:1
Manitoba Maple	26/09 - 01/10	78.1	34.900	2.2:1
Common Lilac	03/10 - 29/10	181.0	9.300	19.5:1
Green Ash	15/10 - 23/10	53.5	37.300	1.4:1
Russian Olive	16/10 - 31/10	51.0	11.997	4.3:1
Bugnet Pine	22/10	55.0	0.488	112.7:1
Amur Maple	21/09	10.0	3.240	3:1

1990 Seed Collection

In addition 98 kg of caragana seed was purchased from the Ferry Bank Hutterite Colony and 2.25 kg of Siberian larch seed was purchased from Schumacher, New York. The Alberta Special Crops Research and Horticultural Center collected 4 kg of Russian olive, 240 g of Albol currant, 300 g of Norway spruce and 100 g of Siberian salt tree seed for the shelterbelt program.

A total of 10.1 kg of seed was sold to 22 private growers and 1.92 kg of seed was given to contract growers.

Fruit Crop Production - Simone Dalpé

In 1990, 880 day neutral plants and 510 June bearing plants were planted out in April, and the raspberries were moved to another field.

Harvest of the fruit from the day-neutral strawberry plants amounted to 158.864 kg, and 40.528 kg of raspberries were picked.

Chemical Application - Roy Marquardt

The stores in the chemical and general warehouse were reorganized and inventories were updated and computerized. Application of herbicides, insecticides and fungicides were made when necessary, and good control was achieved. Considerable time was spent on trying to control scentless chamomile which had been found on the surroundings of the production areas, by actually pulling, mowing or chemicals. This was to prevent it getting established on the nursery.

Woody Ornamental Research - Thean Pheh

Recommendations were made from the Regional Woody Plant Test Program this year, now in its eighth year, and some more plants have been obtained for planting next spring. The site at Lacombe Nurseries has been sold, and it was impossible to take records this fall because of weeds. We will contact the new owner to find out his intentions.

Winter injury on an interstock trial for apples was severe. We will try again as most of the injury occurred on cultivars that are commonly grown.

Our other trials are continuing, we continue to take records and samples of the fertilizer trial on trees and shrubs; the Regional Woody Plant Trial for Woody Ornamentals is only in its third year and recommendations are only made after the sixth growing season; the recording of soil moisture and yields of crops affected by shelterbelts continued; a report is available upon request (ATN&HC Report #91.SO1). There were 15 unnamed seedlings among the 87 cultivars in the All-America Annual Flower Trial in 1990, and the 1991 Award winners were also on display.

Extension:

Four issues of 'Alberta Nursery Notes' were written and distributed during the past year, and some articles from it have been reprinted in other publications.

Four Pruning Courses were given in March, three at the Centre in Edmonton and one at ASCHRC, Brooks. There were four perfect scores, and four failed to achieve the 60% required for a pass.

FARM SERVICES

Farm Report - Al Faulkner

Farm Services duties include field irrigation, cultivation and seeding, vehicle and equipment maintenance and control, general maintenance and repairs, and other duties as required. The section plays an important part in the day to day running of the Centre.

During the 1990 season, 13 seasonal staff were hired to help the permanent employees. This resulted in a total of 1184.53 work days for the year.

Cultivation

Cultivation and row crop cultivation was carried out on a day to day basis to keep within the 0% guidelines.

Cultivation was also used to control weeds, and at the end of the season, fallow and lifted areas were cultivated.

Seeding

Due to the application of composted stockyard manure to many areas, no green manure cropping was done.

Grass seeding was carried out in various fields. During the 1990 season 550 kg of crested wheat grass was seeded on 7.33 hectares.

Fertilizer and Manure

During the season, five different fertilizers were applied at the Centre. This resulted in a total of 6749.5 pounds of fertilizer being used on 43.5 acres.

Approximately 27 tonnes of composted manure was used, on ten areas at the Centre. As part of our total conservation effort, Edmonton Stockyards deliver pen cleanings which we compost and spread on production fields to maintain organic matter levels.

Vehicle Maintenance

During 1990 service and vehicle maintenance prevented break downs.

CVS Vehicle Inspectors did an inspection of the government owned vehicles and stated that our vehicle maintenance program was one of the best in Alberta.

Irrigation

An access line was run from field 8 to field 29, and was used to provide immediate water when one of the pumps failed. As a result either pump can now supply water to both sides.

We also provided a pump and aluminum line that was used to pump water to fill the reservoir at the Ukrainian Village.

Rodent Control and Vandalism

In 1990 we removed five porcupines from the nursery as they caused severe damage to a selected pine tree plantation. We also removed nine beavers from the creek area.